UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration

The Agricultural Research Administration--Its Philosophy and Organization

Talk by B. T. Shaw, Deputy Administrator, Agricultural Research Administration, U. S. Department of Agriculture, before Office of Naval Research, Monday, May 8, 1950.

The Agricultural Research Administration, as its name implies, is a scientific organization in the Department of Agriculture In addition to conducting research programs, it carries out control and regulatory measures which require technically-trained personnel. These measures--of which the Federal Meat Inspection Service is but one example--are designed to protect the health and welfare of our people. The objectives of ARA, to state them very generally and perhaps over-simply, are: (1) To seek through basic research an understanding of our agricultural environment, and (2), through applied research, to make this knowledge available for the benefit and welfare of agriculture and the Nation through sponsorship or direction of various programs and activities.

It is always difficult to explain an organization clearly, but in outline the ARA consists of the Administrator's Office, the Office of Experiment Stations--which administers Federal grants to State Agricultural Experiment Stations--and six bureaus: The Bureaus of Animal Industry, Dairy Industry, Agricultural and Industrial Chemistry, Human Nutrition and Home Economics, Entomology and Plant Quarantine, and Plant Industry, Soils, and Agricultural Engineering. Each Bureau Chief reports directly to the Administrator. The Chief of the Office of Experiment Stations is also an assistant administrator of ARA.

Since the establishment of ARA in 1942, the Administrator's responsibility has been broadened to include--in addition to the supervision and direction of its own bureaus--the coordination of all Department research other than economics. This means, primarily, bringing in the research of the Forest Service and the Soil Conservation Service.

The latest step was taken last year when the Administrator was assigned the job of administering the Research and Marketing Act, which previously had been handled in the Office of the Secretary. This legislation was passed in 1946 by Congress to provide increased emphasis on research and marketing work as an aid in solving agriculture's critical problems in production and in marketing. It added very substantially to our research job, especially in marketing and use of farm products.

Following the establishment of a few agricultural experiment stations by States after the middle of the last century, the Congress in 1887 provided legislation setting up a system of State experiment stations at land-grant colleges for the purpose of carrying on original research in agriculture. It also provided that the Department of Agriculture give some guidance to lines of inquiry, as well as other advice and assistance. The Office of Experiment Stations was organized for carrying out those provisions. It is now part of the Research Administration. It is the vehicle through which ARA administers Federal-grant funds which Congress has provided from time to time for research in the State experiment stations. It assists in developing cooperation among the States and between the States and the Federal Government. The OES also approves in advance projects to be financed

wholly or in part by Federal-grant funds, and it reviews these projects annually. There are now 53 independent experiment station systems in the States, Alaska, Hawaii, and Puerto Rico, where nearly 4,000 lines of research are financed by Federal-grant funds. The research carried on by the State experiment stations emphasizes primarily problems of the particular State although much of it is highly significant on both a regional and national basis. In cooperation with States, we seek to coorelate Federal and State effort so as to use the facilities and resources of each to the best interest of agriculture.

Through the years since the passage of the Hatch Act in 1887, attempts have been made to define differences in responsibilities of the State experiment stations and the Department of Agriculture for agricultural research. The language of the Hatch Act provided, "That it shall be the object of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals, etc...and such other researches or experiments bearing on the agricultural industry of the United States as may in each case be deemed advisable, having due regards for the varying conditions and needs of the respective States or Territories." Secretary of Agriculture Coleman outlined his views of the general relationship of the Department to the State experiment stations in his annual report of February, 1889, as follows: "The Department of Agriculture can aid the experiment stations in their relations to each other, and in connection with the agricultural public, to be first among the stations, the Department should be the servant of them all. It should exercise not dictatorship but leadership."

In practice, the most effective research programs are those based upon joint planning and cooperative effort of both the Federal and State groups. Few of our agricultural problems are limited to the confines of a single State and results of well planned research are seldom limited in their application to State boundaries. For example, when the cause of Granville wilt of tobacco was discovered in North Carolina, it was thought to be a local problem and was given the name of the county in which it was found. Since then it has been found in several States and in foreign countries where tobacco is grown. Studies of unfavorable growth and reproduction in livestock grazed on Florida ranges led to the discovery of mineral deficiencies in the soil which could be corrected by applying small amounts of these minerals. The results have been applied to coastal plain soils of other States in the Southeast. Many similar examples could be cited in illustration of the fact that State lines do not limit the application of research results. Most problems of this type are attacked cooperatively. The extensive cooperation between States and between the States and the Department indicates that an increasing amount of agricultural research is being conducted cooperatively and is being coordinated on a regional and national basis.

Thus, in view of such developments, provision is made at ARA's top level for developing cooperative relationships with the State experiment stations as well as for giving over-all guidance to the Department's research programs.

The bureaus actually conduct the Federal scientific studies carried on within ARA. Our Plant Industry, Soils, and Agricultural Engineering Bureau will serve as an example. The program of this Bureau is broken down into four areas--field crops, horticultural crops, soils, and agricultural engineering. An assistant bureau chief heads up each field of work. Under field crops there are seven divisions covering cereals, forage crops, sugar, rubber, cotton, tobacco, and weeds. The head of each division is in charge of projects supervised by project leaders. In the Cereals Division there are projects covering such crops as corn, wheat, and rice. Under each project are sub-projects or research teams which may be working at a number of stations scattered throughout the 48 States.

All levels of the ARA organization have an important part in research program initiation and planning. Because of his close relation to a particular problem and his ability to see the need for new work or a modification of that already in progress, it is natural that much of our research starts with the scientific worker himself. For sake of illustration, say that an individual plant geneticist initiates a proposal for a new line of research on corn. He considers his proposal in terms of related genetic investigations in his own area of operation and that of cooperating institutions. Then he forwards the proposal to the project leader responsible for all corn work. The project leader reviews the proposal in terms of its scientific merit, its likelihood of producing results, and its relationship to other suggestions for research on corn. The division head appraises it in relation to suggested projects on other crops with the object of developing a well-rounded cereal crops program to best meet farmers' needs. If approved, the corn proposal goes to the assistant chief of bureau in charge of field crops where it is surveyed in terms of program proposals advanced from all seven divisions for which he is responsible. The Chief of the Bureau must likewise review the proposal, his evaluation being based on the relationship of programs proposed in the other broad fields of the Bureau--that is, horticultural crops, soils, or agricultural engineering.

The result, thus far, is a proposed program study in a field which reflects the Bureau's judgment of work most needed. But still broader considerations have to be taken into account. Does the work affect programs of other bureaus? Has full account been taken of the work being done in cooperating State experiment stations? Is it related to work being conducted in other USDA agencies or other agencies of the Government? These and other questions must be decided as the proposal is given final review in the Administrator's Office in line with its coordinating and directing functions. A new line of research suggested by an advisory committee would travel the reverse route to the one just described. It would be the project leader's task, in consultation with subject-matter specialists, to develop the formal project. And, of course, it is the project leader and the individual scientists who decide what leads to follow and which experiments to conduct within the approved project framework.

Staffing the ARA organization are approximately 16,000 Federal employees. Thirty-four hundred are located in the Washington area--the rest at field stations and laboratories, at State Experiment Stations on a cooperative basis, and in 27 foreign countries--principally in Central and South America. About 7,600 of our staff are actually engaged in research or in work closely related to it, while 8,400 perform services connected with control and regulatory programs. And if you listed our scientists alphabetically, you would find them in the full range--agronomists, botanists, chemists, and on to zoologists.

This widely diverse group of staff members conduets research or works on control and regulatory programs at nearly 1,250 locations in and outside the United States. They perform their work in a physical plant--laboratories, field stations, and other establishments--valued at some $28,000,000. Added to this are facilities made available at State experiment stations on a cooperative basis, which increase the value of the research plant several-fold.

Perhaps the cornerstone of our research facilities is the Research Center at Beltsville, Maryland. It is there that much research of a national interest is conducted. The Center is attached to the Administrator's Office and is maintained chiefly for the benefit of the ARA bureaus whose laboratory work is headquartered there. However, a few other Department agencies also use its facilities.

From the standpoint of research coordination, the Center has considerable advantage. For one thing, it is possible to bring to bear on one problem, in one

place, the experience and ability of many different kinds of scientists. Another important advantage is its relationships with field stations and State experiment stations. Under fundamental breeding work, for example, new plants and animals are developed at the Center and then sent to stations in various parts of the country for further development.

The Center is located on about 12,000 acres and includes 40 major buildings which are set up to meet specific research needs. It has 100 barns and storage buildings and 500 small-animal and poultry houses for housing experimental animals, fowl, and equipment. The livestock include about 3,000 experimental farm animals, 5,500 small animals for laboratory tests, and more than 10,000 mature laying and breeding fowls. It has greenhouses which put five acres under glass, an apiary for bees, a granary, shops, warehouses, and other such facilities. On the Center's land are experimental pastures, ranges, orchards, gardens, fields for cultivated crops, timber stands, and soil-treatment plots.

Chief among many other research facilities are what we call our four regional laboratories and the Bankhead-Jones laboratories. All these facilities were provided by the Congress in answer to special research needs. The four large regional research laboratories were established to help meet one of agriculture's greatest problems--that of finding broader outlets for products of the land. Located at Philadelphia, New Orleans, Peoria, Illinois, and Albany, California, their mission is to find new and wider uses for farm commodities. In general, they work on products of economic importance to the areas in which they are located. There are nine Bankhead-Jones laboratories. Their work is to perform research on agricultural problems of regional significance that cannot adequately be performed at Beltsville or by the States individually or in groups. Usually the laboratories are located at land-grant colleges, where library and other facilities are available. An example of these nine research laboratories is the one at Michigan State College, East Lansing, where extensive poultry research is under way.

So far you have been hearing about the ARA as an organization, the people who staff it, and the facilities they have for conducting research and other types of programs. Perhaps of more fundamental interest to you is the kind of job we have to do, how we believe our job should be done, and what we are doing.

First, a look at the nature of agricultural research. You will notice many points of similarity between our kind of research and yours. But there are also significant differences.

Perhaps agricultural research is chiefly unique for the breadth of interest it embraces. Our studies apply directly to farmers, and--more or less indirectly through work that touches human welfare--to all 151 million of us. There are six million farmers in the United States. They produce everything from roses to beef cattle. Each can have a problem that calls for research. So can those who are concerned with the processing and marketing of farm products. The farmer's wife has problems, too. As might be expected, this broad interest is constantly expressed by individuals and groups in all segments of agricultural activity. Congress also pays close attention to the details of our work. This widespread interest is wholesome, and it helps to keep our program close to the problems of the people.

Agricultural research is largely applied research. Our aim is for more basic research and we are making progress in that direction. But we want to go still further. We will always have a large amount of applied research, because we must carry developments to the stage that they can be adopted by farm families.

Agricultural research is largely public-supported. Of approximately $100,000,000 spent yearly in the United States for agricultural research, $59,000,000 comes from Federal appropriations and most of the remainder from State appropriations. About $12,000,000 of the Federal total goes to State experiment stations in Federal grants.

Agricultural research is a function of multi-functional agencies. These functions are research, education, regulation, and service. They are carried out by the Federal Department of Agriculture, the land-grant colleges, and State departments of agriculture.

Our philosophy for successful research rests largely upon two factors: the ability of the scientist and the way in which his organization is directed for most effective use of all scientific skills. We recognize the absolute necessity for (1) giving full play to specialized research talent on an individual basis, and (2) sound management to obtain maximum results from the total research program.

Let me consider point one first. The job of the science administrator--no matter at what level he works--is not merely one of administration in the typical sense of the word. One of the chief purposes of research direction is to realize the full potential of the scientist's ability. This means providing the scientist with the most favorable "climate" possible for imaginative and productive research. It requires--among other things--furnishing him with the proper facilities and equipment when he needs them, making it possible to conduct his research in an atmosphere of freedom, to publish his results freely, and to take advantage of an exchange of free criticism and appraisal between him and his fellows.

In ARA we attempt to make use of every brain in our ranks. Ideas for the initiation of research travel a two-way street. They come to the top from individual workers, just as they can originate from other points. It is our desire in ARA to promote scientists on the basis of their productivity alone. We are making some progress. Our goal is to make it possible for our scientists to begin at the bottom of our professional grades and advance to our top levels of job classification without having any administrative duties whatsoever.

But the complex nature of agricultural research requires more than the efforts of the highly-skilled specialist. To achieve greatest results from all skills and abilities--to give the public a good return on its investment--requires sound management. Almost any type of endeavor requires some direction. Research is no different in that respect. But direction of research is much more difficult than management in many fields because you are dealing with the sensitivity of the scientist who has a natural antagonism toward restriction of any kind. If any planning is required, he feels that he alone is the one to do it. He wants funds, labor, facilities, and equipment when he needs them--and from there on he wants to be left alone to pursue his work in his own fashion. To carry this further, many scientists do not even believe that there is such a thing as research administration--or a place for it in the field of science. They see it merely as a means for the administrators to interpret to the scientists the "red tape" that the administrators themselves have created. They often fail to see, for example, the connection between the fulfilling of their needs for facilities and equipment and action on the part of administrative people to make them available--to say nothing of the type of planning that seeks to make the most of individual effort in a coordinated research effort. But in spite of the scientist's understandable feeling about research and planning, the two go hand in hand by the very nature of the work. The setting up of a research project, for example, always requires planning. You first have to define your objective. You appraise the resources available for doing the job, and then--you decide how best they can be used to achieve the end you are seeking.

How ARA as a whole attempts to bring together specialized effort and sound over-all direction can best be explained by illustration: One of agriculture's big research problems today is to develop livestock that will thrive better in the warm, humid climate of our Southern and Southeastern States. This is part of a broadscale effort to revamp the agriculture of that area. Involved, first of all, is research in animal breeding. Also involved is animal disease and parasite control. It requires research for plants that will make good pastures, that fit well in crop rotation schemes, and which can be used as substitutes for crops now being produced in over-abundance. It calls for research in soil management in support of crop production, for studies aimed at improving farm equipment and machinery, for research in farm management to see how incomes will be affected, and the production and marketing problems involved in transition from present farming systems, and for work in human nutrition for measuring nutrition levels now existing, as well as those which will be possible and desirable under an improved system of farming. Also involved is research in what to do with displaced peoples if less intensive systems of farming are adopted.

ARA scientists located at various points in the area are working on individual problems in these closely interrelated fields. But they cannot work independently of each other. They know that what develops in one area of study may vastly affect developments in another. So, they work together voluntarily to obtain most effective results. For the same reason, they work with State experiment station people concerned with the same or related problems. Thus, the scientists themselves through their community of interest and dependence--one on another--lay the groundwork for the coordinated and integrated approach to agricultural research.

The part of the science administrator in this picture is to assure the best use of both individual and combined effort in achieving the research goal. In doing so, we put into action the coordinated approach to research that integrates not only individual sciences in our agency but related scientific effort in cooperating agencies and institutions as well. By bringing in the latter, we encourage the dovetailing of the physical and biological sciences with the social sciences and take advantage of the countless cooperative relationships available to us.

We use several mechanisms for keeping in touch with research developments and need for action. These include: A research council of USDA agency representatives which advises the Administrator on the research program as a whole; advisory committees which represent producers, distributors and consumers; research panels that review specific research fields and problems and make recommendations for more effective programs; and a system of program coordination through which coordinators continually appraise work in progress.

For the fullest return on the research investment, scientific information must reach broad audiences. To us, the farmer stands first in line. The principal avenue to him is the Agricultural Extension Service, with headquarters at each State College and subject-matter specialists who work with farm people in every rural county. Mass media--newspapers, magazines, radio, and other outlets--are also used widely to reach the farmer, as well as the consumer, who stands second in line for this information. And we have at hand various arrangements for extending our information to those in foreign countries who want it.

What research has meant to agriculture and the national interest in total is very difficult to measure. Perhaps a specific example will illustrate: Insects are estimated to cause a loss of $4 billion annually. They harm plants, animals, and

humans. Without entomological research and the resulting insecticides and control programs, our plant production--the basis of all animal and human food--would be hazardous indeed. Grasshoppers, for instance, could devour vegetation unmolested. With animals the story would be the same. Discovery that an insect was the cause of cattle tick fever resulted in steps that have virtually eliminated damage that year after year was sapping the strength of the livestock industry in a large part of our country. And, without means to fight them, man himself would be defenseless against disease-carrying insects.

The potentialities of agricultural research can be forecast by some consideration of what we are doing now. Let us start with chemicals for insect control. Among many other experiments, our entomologists are working on an insecticide that--if it works--would be bad news, indeed, to the insect world. The objective is to develop a chemical that could be put in the soil before a crop is planted. The plants would take up the chemical and insects that feed on them would be killed. The insecticide--after a sufficient period in the soil--would then break down into a phosphate compound like ordinary fertilizer.

In efforts to find new and wider uses for agricultural commodities and by-products, our scientists have learned to make synthetic fibers from corn, peanuts, casein, and chicken feathers. They cooperated with the Florida Citrus Commission to develop frozen concentrated orange juice. They have discovered how to make rutin from buckwheat and how to mass-produce penicillin. Looking ahead, I am confident that research will open many new avenues to farm products.

Development of hybrid vigor in plants and animals has been a highlight in agricultural research the past 20 years. Polyploids will be a big thing in the next twenty. The term polyploid is used by the scientists to describe plants that have three or more sets of chromosomes in the somatic cells. By increasing the number of sets of chromosomes, our scientists are already fashioning polyploid fruits of giant size and of taste and quality never before attained.

In livestock work, science is going forward to improve our breeds to both the farmer's and consumer's benefit. A new hog is beginning to appear--called the meat-type hog. Our old market hogs have furnished meat for two people and fat for three. The new type furnishes meat and fat on a more equal basis. In other words, he has less fat and more of the preferred cuts like ham, bacon, and loin. Other livestock work has potentialities of equal significance.

Food canning could be revolutionized as the result of a discovery by one of our laboratories. Experiments showed that in the process of canning, vegetables or milk could be sterilized by adding a very small amount of subtilin, an antibiotic, and then giving the sealed cans a relatively mild heat treatment. This procedure was as effective in destroying spoilage organisms as conventional methods, which require long heating at high temperatures that lower the quality of the canned product. However, we still need to find many of the answers to this new work.

Through these and other researches, our scientists are meeting the Department's basic task of acquiring useful knowledge.

To serve its purpose most effectively, agricultural research must meet the needs of the times. Of course, from a practical standpoint, research--both basic and applied--will have to forge ahead on agriculture's continuing problems. Control of disease is but one example. But agriculture again finds itself in a period when it has large supplies of many commodities for which demand has slackened.

For research this means driving ahead to help the farmer produce more efficiently and at lower cost, and, more especially, to work more aggressively on all fronts to enlarge his market. But the times also call for us to be more and more occupied with what happens to commodities after they leave the farm. We must work to improve the economy and efficiency of the marketing system itself to the benefit of both the farmer and the consumer. We need to do much more in nutrition, not only for greater food consumption but also to improve the health and welfare of our people. In total, we need to go into the market place with the same scientific effort that we have given in the past to agriculture's production effort.

In fact, today we have a rare opportunity to justify even further the faith of the people in research. With the tools we have and an intelligent approach to our job, future benefits from research should surpass by far the achievements that have helped make American agriculture and our Nation great.

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